

GORDON TECH HIGH SCHOOL CURRICULUM GUIDE

Course Title: Advanced Algebra
Department of: Mathematics

COURSE DESCRIPTION: The student will expand the knowledge obtained in first-year algebra to increasingly more complex problems and applications.

COURSE GOALS / OBJECTIVES: The student will:

- use the power of mathematical abstraction and symbolism to represent and solve real-life situations
 - that involve variable quantities with expressions, equations, and inequalities
- use tables and graphs as tools to interpret expressions, equations, and inequalities
- operate on expressions, and solve equations and inequalities
- use patterns, relationships, and problem-solving strategies to investigate and understand algebraic content
 - use instructional technology to provide meaningful visual representations of algebraic concepts
 - communicate algebraic notions verbally and in writing
 - read and interpret written presentations of algebraic ideas with understanding
 - model real-world phenomena with a variety of functions
 - translate among tabular, symbolic, and graphical representations of functions
 - analyze the effects of parameter changes on the graphs of functions

COURSE OUTLINE:

Unit 1: Review of Elementary Algebraic Concepts

- perform basic operations with pairs of real numbers
- simplify a numerical expression using the rules for order of operations
- evaluate an algebraic expression using the rules for order of operations
- simplify and evaluate an expression containing exponents
- rewrite an expression by using the distributive property
- simplify an expression by combining like terms
- simplify an expression involving opposites and absolute values

Unit 2: Solving Equations

- solve an equation by using the addition or subtraction property of equality
- solve an equation by using the multiplication or division property of equality
- solve an equation by using two properties of equality
- solve an equation with the variable on both sides
- solve an equation that contains parentheses
- solve an equation that contains fractions
- solve an equation that contains decimals
- solve an equation that contains absolute value

Unit 3: Linear Inequalities

- find and graph the solution set of an inequality by using the addition or subtraction property of inequality
- find and graph the solution set of an inequality by using the multiplication or division property of inequality
- solve an inequality by using two properties of inequalities
- find and graph the solution set of a conjunction and a disjunction of inequalities
- find and graph the solution set of an inequality containing absolute value

Unit 4: The Coordinate Plane

- graph a relation and determine its domain and range
- determine a relation from its graph
- determine whether a relation is a function
- find values of a function described by an equation
- graph a linear equation using a table of x -values and y -values
- find the slope of a line, given two of its points
- write an equation of a line, given a point on the line and its slope
- write an equation of a line, given two points on the line
- write an equation of a line, given a table or graph
- write an equation of a line, given its slope and y -intercept
- find the slope and y -intercept of a line, given its equation
- graph a line using its slope and y -intercept
- graph a line using both of its intercepts
- determine whether a given point lies on a given line
- determine whether two lines are parallel, perpendicular
- graph a linear inequality in two variables

Unit 5: Systems of Linear Equations and Inequalities

- solve a system of two linear equations in two variables by graphing
- solve a system of two linear equations in two variables using the substitution method
- solve a system of two linear equations in two variables using the linear combination method
- solve a system of three linear equations in three variables

- solve a system of two linear inequalities in two variables by graphing

Unit 6: Polynomials

- simplify an expression containing positive integral exponents
- simplify an expression containing negative integral exponents
- simplify the sum or difference of polynomials
- multiply polynomials
- factor out the greatest common monomial factor from a polynomial
- factor a trinomial into the product of two binomials
- simplify the sum or difference of polynomials
- multiply polynomials
- factor out the greatest common monomial factor from a polynomial
- factor a trinomial into the product of two binomials
- factor the difference of two squares
- factor a perfect-square trinomial
- factor a polynomial completely
- factor a polynomial by grouping pairs of terms
- factor the sum or difference of two cubes
- divide a polynomial in one variable by a binomial using the method of long

division

Unit 7: Applying Equations and Inequalities

- solve a word problem involving percents
- solve a word problem involving ages
- solve a word problem involving consecutive integers
- solve a word problem involving money
- solve a word problem involving compound inequalities
- solve a word problem involving a system of equations
- solve a word problem involving quadratic equations

Unit 8: Higher-Degree Equations and Inequalities

- solve an equation of degree 2, 3, or 4 for its rational roots by factoring
- find and graph the solution set of a second-degree or third-degree inequality in one variable
- divide a polynomial $P(x)$ by $x - a$ using synthetic division
- evaluate a polynomial using synthetic substitution
- determine whether a binomial $x - a$ is a factor of a polynomial $P(x)$
- find the rational zeros of an integral polynomial
- factor an integral polynomial into first-degree factors
- find the rational roots of an integral polynomial equation of degree greater than

two

Unit 9: Rational Expressions

- find the domain of a rational function
- find the zero of a rational function
- simplify and evaluate a rational expression
- multiply and divide rational expressions
- add and subtract rational expressions
- simplify a complex rational expression
- solve an equation containing rational expressions

Unit 10: Radical and Rational Exponents

- find the square root of a positive number
- find the domain of a function involving square roots
- simplify an expression containing the sum or difference of square roots
- simplify an expression containing the product or quotient of square roots
- simplify a radical with index greater than 2
- write an expression with rational exponents in radical form, and vice versa
- simplify an expression containing rational exponents
- add and subtract expressions containing radicals
- multiply and simplify expressions containing radicals
- divide and simplify expressions containing radicals
- solve an equation containing rational exponents

Unit 11: Complex Numbers

- solve an equation of the form $x^2 = k$, where $k < 0$
- find the sum or difference of complex numbers
- find the absolute value of a complex number
- simplify the product or quotient of complex numbers
- raise a complex number to an integral power
- solve a quadratic equation for its complex roots by completing the square
- solve a quadratic equation for its complex roots by using the quadratic formula
- find the three cube roots of a nonzero integer which is a perfect cube

Unit 12: Polynomial Equations and Functions

- find the sum and product of the roots of a given quadratic equation without solving the equation
- write a quadratic equation in general form given its roots
- describe the nature of the roots of a quadratic equation by finding its discriminant
- solve a radical equation
- find all the roots of an integral polynomial equation
- graph an integral polynomial function of degree n with n distinct real zeros
- find the remaining zeros of integral polynomials given one nonreal zero

Unit 13: Coordinate Geometry and Quadratic Functions

- find the distance between two points
- find the midpoint of a segment
- graph an equation of the form $y - k = a | x - h |$
- graph a parabola of the form $y - k = a (x - h)^2$
- change an equation of a parabola from general form to standard form
- determine the vertex and axis of symmetry of a parabola described by an equation in standard form or in general form
- determine whether a function is even or odd

Unit 14 Conic Sections

- write an equation in standard form of a circle given its center and radius
- write an equation in standard form of a circle given its center and a point on the circle
- graph a circle given its center and radius, its center and a point on the circle, or its equation
- write an equation in standard form of an ellipse given its four vertices
- write an equation in standard form of an ellipse given two vertices and its foci
- graph an ellipse given its equation
- write an equation in standard form of a hyperbola given its vertices and foci
- write an equation in standard form of a hyperbola given its vertices and asymptotes
- graph a hyperbola given its equation
- find the vertices, foci, and asymptotes of a hyperbola given its equation
- find the coordinates of the center, the vertices, and the foci of an ellipse or a hyperbola given its equation
- graph a rectangular hyperbola given its equation

Strategies for Achieving Outcomes:

Small groups of students will work as a team to share ideas, solve problems, and justify conclusions.

Students will use manipulatives to help them to grasp abstract concepts on a concrete level.

Assessments:

Homework assignments

Test and quizzes

Portfolios, which may contain results of works such as these:

open-ended questions, problems, and tasks: The student discusses in writing a mathematical situation, formulates hypotheses, makes generalizations, and so on;

research projects: The student uses resources outside the classroom in order to complete a long-term project;

journal entries: The student keeps written entries detailing such things as the methods used in solving a particularly difficult or interesting problem, or reflections and reactions about specific assignments or class activities;

cooperative learning activities: The student writes a summary of the work accomplished;

demonstrations: Students working individually, in pairs, or in groups demonstrate ideas using manipulatives, graph paper, compasses, calculators, or computers;

investigations: The student keeps a log which includes the date, a description of the work done, and questions the student has for the teacher. The teacher's response to the questions is recorded in the log;

models and simulations: The student writes a summary which describes the activity and includes relevant diagrams, sketches, and photographs;

non-routine problems: The student restates the problem in his own words, explores the problem by drawing a picture or a chart, chooses a strategy such as guess and test, look for a pattern, logical deduction, working backward, or exhaustive listing, and carries out the chosen strategy to solve the problem;

interviews: The student talks while the teacher listens and asks questions regarding the learner's thought processes as related to specific problems;

time-staggered samples: The student collects work samples dealing with the same mathematical idea completed at different times during the year.

Error notebooks: students keep a list of specific homework, test, and quiz problems that resulted in errors. A three-column format might include a statement of the problem as posed, a statement of the exact error made, and a correction and comment.

Specific Examples of Assessment Items:

Choose three different types of graphs found in a newspaper or magazine. Write a report that addresses what each graph represents, for whom each was intended, which portions of each are misleading, and how each graph could be improved.

Use the school library to find a real-life example of two quantities that vary inversely with each other. Sketch a scatter plot of the data. Then find a model for the relationship and use your model to make a prediction.

Compare the process used to multiply two polynomials with the process used to multiply two radicals. How are the two processes similar? Use examples to illustrate the similarities.